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ON THE ANTENNÆ IN THE LEPIDOPTERA.

BY AUG. R. GROTE, A. M.

In a paper read before the Portland meeting of the American Association for the Advancement of Science, I endeavored to show that the antennæ in the moths, or night-flying Lepidoptera, were more highly specialized than in the butterflies, and that this specialization of structure was correlated with habit in these insects. I stated that the antennæ were more actively used by the moth than by the butterfly, and I suggested that their sensitiveness was a protection and an assistance to the night-flying moths in directions where a change to a diurnal habit rendered such sensitiveness less necessary to the butterfly. In two instances I was led to reject conclusions with regard to the antennæ that had already appeared in print. The first of these is the hitherto accepted and arbitrary division of the Lepidoptera into two sections under the terms Rhopalocera, or club-horned, and Heterocera or diversely-horned. I endeavored to show, that the change in the antennal form was a gradual one, from the neuropteriform antennæ of the Tineidæ, or lowest moths, to the butterfly-like antennæ of the Castniares, or highest moths; that the antennæ of the Hesperidæ were quite different from the butterflies; and that the change in antennal structure throughout the suborder was really expressed by a greater rigidity and equalization in length, or was one of direction and attitude. As the antennæ become less serviceable to the insect they become more rigid and in position more elevated above the head, as in the butterfly, while in the moth they are more whip-like and are directed forwards or, in a state of rest, frequently thrown backwards by the sides of the body, beneath the wings. The second instance is that of Dr. Clemens,* who came to the conclusion that the antennæ, in the Lepidoptera, "instead of being organs of any special sense, as they are usually regarded, are instruments of atmospheric palpation." I have endeavored to show that Dr. Clemens' experiments with the moth *Platysamia cecropia*, instead of being confirmatory of this view, point to an exactly opposite conclusion. Neither by smell nor hearing could the night-

* Journal Acad. Nat. Sci. Phil., 1859, p. 122.

flying moth, deprived of its antennæ, become sensible of direction or locality, and under its condition of mutilation it naturally refused to proceed. A very strong argument would indeed be needed to confirm the fact that in a single suborder of insects, so important and widely developed an organ as the antenna was devoted to an exceptional use, while the absence of any structural connection between the wings and the antennæ renders such a construction impossible. It appears rather that the senses of smell and hearing are not differentiated in insects and that the antennæ are organs of perception receiving impressions from either sense. The "assembling" of the Bombyces has its cause probably in the greater specialization of the male antennæ, which are sensitive to the odor of the female as well as to the waves of sound. It is not extraordinary to find such a means for the preservation of the species highly developed in a group where the maxillæ are feebly developed, little or no food is taken, and the duration of life in the reproductional stage is so brief as in the Bombyces. Having watched the free habit of the butterflies, I have thought that these depended more on the organs of vision for a recognition of the sexes, and I have detected instances of necessarily harmless coquetry between the males of Argynnis; an action not unrelated to that observable among dogs and higher animals. Professor Mayer's experiments with the male mosquito, as narrated in the AMERICAN NATURALIST, vol. 8, p. 236, are confirmatory of these views, as showing the sensitiveness of the antennæ to the waves of sound, and it is not unreasonable to suppose that the antennæ of the male insect are particularly sensitive to the peculiar sounds and odors emitted by the female of its own species.

In the absence as yet of conclusive evidence as to cases of peculiar sensitiveness to odor or sound, it may be sufficient to feel sure from what has been adduced of the general functions of the antennæ, and it has been the object of the writer to show that the point of view from which systematists have hitherto regarded the antennæ is unfertile, and to direct attention to the real differences in antennal structure between the butterflies and moths, while showing that the antennæ are modified by desuetude in the former and higher group.